2. Of these 16 cases there are 9 for which computation gave $\geqq +1°$ F., and in all of these the autumn was mild.

3. For 1917 the computations gave the largest negative value, and an excessively cold autumn followed, in fact the coldest in the southeastern part of the United States of the whole 50-year period.

III. THE SOUTHERN AREA (MOBILE, CHARLESTON, AND KEY WEST)

In general, the conditions for autumn temperature forecasts are the same as for the East and North, with the difference that Cairo spring pressure is of less influence. We obtain the following coefficients:

Correlation coefficients × 100

	Δt IX–XI South	Δp III Cairo	Δp V Argentina
Δt IX–XI South	100	29	−42
Δp III–V Cairo	29	100	−18
Δp V Argentina	−42	−18	100

From these we obtain the following equations:

$$29 = 100a - 18c$$
$$-42 = -18a + 100c$$

and the values for a and c as follows: $a = 0.22$; $c = -0.38$.

The regression equation for this area is:

(III) Δt IX–XI South $= 0.45\ \Delta p$ III–V Cairo $- 0.33\ \Delta p$ V Argentina

The total correlation between the influencing elements and autumn temperatures in the South is computed as follows: $R^2 = (0.22 \times 0.29) + (0.38 \times 0.42) = 0.2234$; therefore R total $= 0.47$.

In examining the table we find that in all cases in which the computed temperature departures were $\geqq \pm 1°$ F., the observed departures had the same sign. In 1917 the computed autumn temperature departure gave the largest negative value of the whole 50-year period and the autumn was the coldest of the entire series.

Furthermore, we find two years later (in 1919) that the computations gave the largest positive departure, and the autumn in that year was the mildest.

This accordance in all the areas between computations and observations is the best argument for the correctness, usefulness, and importance of my formulas, and leaves no doubt of their practical value.

Departures from the mean

(50 years, 1873–1922)

Year	Autumn temperatures (°F.) eastern United States (Δt IX–XI)						Δp III–V Cairo	Δp V Argentina
	South		East		North			
	Obs.	Comp.	Obs.	Comp.	Obs.	Comp.		
							Mm. Hg.	*Mm. Hg.*
1873	−2.2	−0.1	−2.3	−0.3	−4.6	−1.1	−0.9	−0.8
1874	−0.5	−0.3	−0.2	−0.4	−0.2	0.5	0.7	1.9
1875	−0.8	−0.2	−2.6	−0.4	−3.9	−1.2	−0.9	−0.6
1876	−1.9	−0.2	−2.6	−0.3	−3.2	−1.1	−0.8	−0.5
1877	0.2	−0.4	0.8	−0.5	0.4	−1.2	−0.8	0.1
1878	−0.4	−0.2	0.2	−0.2	0.4	−0.2	0.0	0.5
1879	0.2	−0.2	0.5	−0.3	1.5	−0.3	−0.1	0.6
1880	−0.6	0.0	−1.9	−0.1	−4.0	−0.2	−0.2	−0.2
1881	2.5	0.7	4.8	1.0	2.3	1.1	0.4	−1.5
1882	−0.1	0.5	0.5	0.7	1.7	0.8	0.3	−1.1
1883	1.0	0.0	−1.0	0.1	−0.5	0.2	0.1	0.0
1884	0.7	0.2	2.0	−0.7	2.9	−0.8	−0.3	1.0
1885	−1.1	0.0	−0.8	0.0	−1.7	−0.4	−0.4	−0.7
1886	−0.3	−0.1	0.5	−0.2	0.0	−0.3	−0.2	0.1
1887	−0.7	−0.7	−1.4	−0.9	−2.1	−0.4	0.2	2.3
1888	−0.9	0.4	−1.9	0.6	−2.2	0.1	−0.3	−1.7
1889	−1.1	0.0	−1.5	−0.1	−3.4	−0.4	−0.3	−0.3
1890	0.2	−0.9	0.7	−1.4	−0.8	−2.2	−1.2	1.2
1891	−2.1	−0.1	−1.6	−0.2	−1.0	−0.5	−0.4	−0.3
1892	−1.2	−1.3	−1.8	−1.9	−1.2	−2.1	−0.8	2.8
1893	−0.1	0.0	−0.7	0.0	−0.4	0.4	0.4	0.6
1894	−0.4	−0.2	0.5	−0.3	−0.6	−0.6	−0.4	0.1
1895	−0.2	−0.7	−0.1	−1.0	−1.1	−1.2	−0.5	1.4
1896	1.1	−0.8	0.8	−1.1	−2.9	−1.2	−0.4	1.8
1897	0.8	0.1	0.8	0.5	3.5	0.7	0.3	−0.6
1898	−0.7	0.0	0.3	0.0	−0.6	−0.4	−0.4	−0.7
1899	0.7	0.7	0.4	1.0	3.0	1.0	0.3	−1.8
1900	1.6	0.1	3.2	0.2	3.4	0.3	0.2	−0.1
1901	−2.0	0.5	−2.3	0.8	−0.1	1.0	0.4	−1.1
1902	1.2	0.8	1.5	1.1	1.7	0.7	0.0	−2.3
1903	−1.6	−0.1	−2.0	−0.2	−1.2	0.5	0.6	1.3
1904	−0.3	−0.4	−1.5	−0.5	1.0	−0.5	−0.2	0.8
1905	1.2	0.1	0.0	0.2	0.1	0.3	0.2	−0.1
1906	0.7	1.0	1.2	1.5	0.6	1.7	0.7	−2.1
1907	0.3	−0.6	−1.0	−0.8	−1.5	−0.7	−0.1	1.6
1908	−0.4	−0.2	−0.3	−0.2	2.4	0.4	0.5	1.2
1909	0.3	−0.9	−0.6	−1.3	1.0	−1.6	−0.7	1.7
1910	−0.2	−0.5	0.2	−0.6	−0.1	0.0	0.4	2.0
1911	2.0	0.1	0.6	0.2	−2.2	0.2	0.1	−0.2
1912	0.3	0.7	1.0	1.2	1.6	2.4	1.5	−0.2
1913	−1.0	0.2	−0.3	0.3	1.3	0.3	0.1	−0.5
1914	−0.6	0.6	−0.5	0.9	2.3	1.7	1.0	−0.5
1915	2.2	1.0	2.2	1.4	2.3	1.0	0.0	−3.1
1916	−0.1	−0.6	−0.5	−1.0	−0.1	−2.3	−1.6	−0.4
1917	−2.6	−1.3	−4.0	−1.8	−2.7	−1.3	−0.1	3.7
1918	0.2	−0.2	−0.5	−0.4	−0.7	−0.8	−0.5	0.0
1919	3.6	1.5	3.5	2.1	0.7	2.5	1.0	−3.1
1920	−0.1	0.9	0.7	1.3	2.3	1.4	0.5	−2.1
1921	2.1	0.5	2.6	0.7	1.3	0.1	−0.3	−1.9
1922	1.2	0.7	1.5	1.0	3.7	2.0	1.2	−0.4
δ =	1.26	0.59	1.67	0.86	2.08	1.11	0.61	1.43

HEAVY SNOWFALL OF JANUARY, 1929, AT DUBUQUE, IOWA

551.578.4 (777)

By H. MERRILL WILLS

[Weather Bureau Office, Dubuque, Iowa]

A new record has been set for all months by the heavy snowfall of January. The total fall of 34.3 inches is without precedent in the history of the station. The only previous monthly fall which approached this record was 32 inches in December, 1887. The heaviest single fall in 24 hours was 11 inches on the 4th and 5th. This is the largest single snowfall in the last 17 years. The accumulated average depth at the close of the month amounted to 20.1 inches, and this appears to have exceeded all previous records for the last 36 years, excepting one similar record of 20.5 inches in January, 1910. The snows of the last month have brought the winter's fall to date to 39.7 inches, which is more than a normal entire winter's fall. Practically the entire month's precipitation was from snow, amounting to 3.13 inches, which is the largest for January in 42 years.

The snows of the month were of unusual significance in the character of ground cover which resulted with its devastating effects upon street and highway transportation as well as damage to roofs and other property. Perhaps no snows have every developed greater persistency in accumulating and hardening upon pavements, rendering the operation of vehicles difficult and dangerous at all times after the first heavy fall, on the 4th and 5th. The conditions were decidedly aggravated along street-car lines where the rails became deep channels or ruts in the heavy masses of frozen snow which covered the streets from 6 to 12 inches thick generally and as much as 18 inches thick in places. These conditions steadily grew worse, and the city finally resorted to the use of snowplows, tractors, scarifiers, graders, picks, and trucks from the middle of the month on into February in an effort to

remove the snow and ice. The situation was somewhat improved when the month closed but still very bad generally.

More or less drifting occurred through the month which also interferred with street, highway, and railroad transportation. The first heavy snow, on the 5th, drifted some, causing general delays and blocking country roads for several days. Street-car service was paralyzed for a time, some lines not being able to resume operation for a day or two. Light to moderate snows fell at frequent intervals through the rest of the month, accompanied by considerable drifting which would refill where snow plows had removed the snow. Some interurban busses were unable to run at all during the rest of the month, especially north and east, due to blockades. Trains were frequently off schedule from one to several hours, and a 36-mile branch of one line was entirely closed for practically three weeks. Crews operating snow plows north of the city encountered drifts as deep as 10 feet. Colesburg, a small village about 30 miles northwest of Dubuque, was completely isolated for nearly three weeks. Snow plows operated vigorously day and night for practically a month in an effort to open the roads throughout the territory around Dubuque, and to clear the streets in the city.

Of course, the persistent cold weather was a heavy contributing factor in that only slight melting of the snow occurred and this was immediately followed by freezing and consequent hardening of the snow, which made its removal extremely difficult. Again, on the 22d light rain formed an incrustation upon the snow and also encouraged the hardening of the whole cover, which retarded melting and evaporation later and increased the difficulty of removal.

It was believed a week ago that $200,000 would be a conservative estimate of the loss to business and damage to property resulting from the snows of January in Dubuque and surrounding territory. It has just now been announced that the roofing concerns of the city have placed an estimate of $100,000 upon the damage to property resulting from accumulated snow on the roofs, alone. Gigantic icicles measuring from 5 to 15 feet in length and as large as a man's body have been a common sight about the city and many can still be seen at this writing hanging from the eaves, the most of them having been removed by workmen to prevent possible injury to life or property.

551.506 (73)

NOTES, ABSTRACTS, AND REVIEWS

An exceptional January.—January, 1929, was an exceptional month in several respects but primarily in the unusually irregular sequence and rate of movement of cyclones and anticyclones. The following details of two cases will illustrate this fact. The cyclone of the 3d–8th (see Chart III) came from the Pacific and entered the continent over the coastal waters of British Columbia and the State of Washington on the 3d, followed the course indicated on the above-mentioned chart was centered at Port Burwell, on Cape Chidley, which forms the headland of the south side of Hudson Strait where it debouches on Davis Strait, with central pressure of 28.02 inches at 7 p. m. of the 7th. Pressure at Godthaab, Greenland, at this time was 28.86 inches. The remnants of this immense depression of the barometer could be found three days later far to the westward over Hudson Bay, but the most remarkable case of the displacement of a cyclone center to the northwest by high pressure to the northeast took place between the morning of the 14th when the cyclone center was over Sable Island with pressure 29.38 inches, and the morning of the 19th when it was filling up over the west shore of Hudson Bay with pressure of 29.44 inches, at Churchill. The second cyclone was that of January 18–21. See path as traced on Chart III. Both of these cylones in the 24-hour movement from Kansas City, Mo., in approximately the geographical center of the United States traveled at very great speed and central pressure decreased 0.52 and 0.36 inch, respectively. The first one moved very close to 1,000 miles and the second approximately 1,500 miles. The dynamic considerations involved in this rapid movement and large diminution of central pressure would form the subject of special inquiry were the details of the process known. Unfortunately they are not available and only surface observations are at hand.

These show that the pressure distribution on January 18 was quite favorable to a rapid movement of the center, more so than on January 5. In both cases the centers moved into a region in which there was a rise in surface temperature of 20° F. or more in 24 hours.

Another exceptional feature of the month was the scarcity of snow over the eastern seaboard south of New England. In Washington, D. C., for example but 0.3 inch fell during the month and the winter's total is but 0.5 inch up to this writing, February 11. On the other hand snow was abundant in the northern border States and the Rocky Mountain region. See Chart VII.

Mean temperatures of the month were widely divergent; in the upper Missouri Valley they were as much as 10° F. below normal and in southeastern States 4° above. See Chart I. Evidently much cold air overlaid southern Canada and the northern border States. The trigger that served to release masses of this air in a southward gravitational flow was the eastward movement of cyclonic areas across the Rocky Mountains of which a relatively large number was noted, many of which failed in crossing the continent. It so happened that the great majority of these areas followed a course that took them northeastward across the Great Lakes. Since pressure over the western Atlantic off the Carolinas, as at Bermuda, was high throughout the greater part of the month cold air was prevented from entering the Atlantic seaboard to any marked extent. The daily changes were unusual, in one case an area of at least 29,000 square miles in extent experienced a rise of 20° or more in 24 hours and this was immediately followed by a change in the opposite direction in the ensuing 24 hours. These and other unusual changes that might be mentioned will give some idea of the tribulations of the forecaster who undertook to anticipate the weather of the month.—*A. J. H.*

Cold weather in Europe during January, 1929.[1]—Pressure was much above normal over the whole of western Europe and at Bermuda, the greatest excess being 24.2 mb. at Isafjord, while pressure was below normal over the North Atlantic, where the greatest deficit was 11.1 mb. at Horta. Temperature was below normal except in the north of Scandinavia and in Portugal, being as much as 6° F. below normal in south Sweden and at Spitsbergen, while precipitation totals were deficient except in Spitsbergen and eastern Sweden.

Heavy and continuous rains accompanied by thunder, snow, and hail storms during the first few days of the

[1] Reprinted from The Meteorological Magazine, London, February, 1929, page 24.